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# Outward FDI and domestic investment

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# Outward FDI and domestic investment

## **Abstract**

This paper examines the impact of outward foreign direct investment (OFDI) on domestic investment by applying co-integration techniques to macroeconomic time series data for the United States and Germany. We show that the two countries differ: In the case of the US, OFDI has positive long-run effects on domestic investment while in the case of Germany the reverse effect is reported.

JEL classification: F21, E22, F41

Keywords : Foreign Direct Investment, Investment, Open Economy Macroeconomics

## **1. Introduction**

There is an ongoing debate on whether or not outward foreign direct investment (OFDI) influences domestic investment activities. One strand of the literature argues that OFDI substitutes domestic investment either by shifting production abroad or because investing scarce financial resources abroad inevitably reduces the likelihood of concurrent investments at home (e.g., Stevens and Lipsey, 1992). In contrast, an alternative perspective suggests that greater foreign investment is associated with higher levels of domestic investment. According to this view, firms combine home production with foreign production to reduce costs and raise the returns to domestic production, which in turn increases domestic investment (e.g., Desai et al., 2005).

Unfortunately, the empirical evidence is inconclusive. For example, results by Stevens and Lipsey (1992) suggest that OFD and domestic investment by US multinationals are substitutes. According to a study by Belderbos (1992), the same holds for Dutch food and metal/electronic companies. In contrast, a recent study by Desai et al. (2005) finds a positive relationship between domestic and foreign investment by US firms. Admittedly, given that these studies are focussed on analyzing a limited number of large multinational firms, they do not indicate the overall effect on domestic investment when all (large, small and medium-sized) enterprises increase their OFDI.

To date, however, the macroeconomic relationship between OFDI and domestic investment has hardly been investigated. Two exceptions are the studies by Feldstein (1994) and Desai et al. (2005), who, using aggregate cross country data, find that each Dollar of OFDI reduces total domestic investment by approximately one dollar. Nevertheless, a major problem is

that cross-country studies implicitly assume similar economic structures across countries. In reality, however, production technologies, institutions, and policies differ substantially between countries. Consequently there is room for the assumption that the effects of OFDI on domestic investment may also differ from country to country. Moreover, contemporaneous correlation across countries does not imply causation, and thus these studies may suffer from serious endogeneity biases.

Therefore, in this paper, we use a different approach to examine the impact of OFDI on domestic investment – namely, a co-integration and causality analysis on the basis of macroeconomic time series data for two important global players: the US and Germany.<sup>1</sup> Important results of our study are: OFDI promotes domestic investment in the US, while in the case of Germany the reverse effect is found. In other words, country differences matter.

The paper is organized as follows. Section 2 describes the estimating equation and the data. The estimation results are presented in Section 3. Section 4 concludes.

## 2. Estimating equation and data

In general, we take a comparable approach to Desai et al. (2005) by estimating the following investment equation:

$$\left(\frac{I}{Y}\right)_t = a_1 + a_2 t + a_3 \left(\frac{OFDI}{Y}\right)_t + \varepsilon_t, \quad (1)$$

where  $I$  is domestic investment,  $Y$  denotes gross domestic product (GDP),  $OFDI$  stands for outward direct investment,  $t$  is a linear time trend ( $t = 1, \dots, T$ ), and  $\varepsilon_t$  is the usual error term, which reflects the influence of all other factors. Here, we use gross capital formation to measure

domestic investment. OFDI equals net FDI outflows. Data on capital formation as a percentage of GDP are drawn from the World Bank's *World Development Indicators 2006*. Data on  $(OFDI/Y)_t$  are from the UNCTAD FDI data base. The sample period is 1970-2003 for the United States, for Germany 1971-2004 ( $T = 34$ ).

### 3. Results

#### 3.1. Testing for cointegration

In the first step, we test for the existence of a cointegrating relationship between OFDI and domestic investment by using the autoregressive distributed lag (ARDL) approach developed by Pesaran et al. (2001). This approach is applicable irrespective of whether the underlying variables are purely  $I(0)$ , purely  $I(1)$  or mutually cointegrated, and thus avoids the problems inherent in pre-testing for unit roots prior to testing for cointegration. The error correction representation of the ARDL model for Equation (1) is given by

$$\Delta\left(\frac{I}{Y}\right)_t = b_1 + b_2 t + b_3 \left(\frac{I}{Y}\right)_{t-1} + b_4 \left(\frac{OFDI}{Y}\right)_{t-1} + \sum_{i=1}^k \eta_i \Delta\left(\frac{I}{Y}\right)_{t-i} + \sum_{i=0}^k \gamma_i \Delta\left(\frac{OFDI}{Y}\right)_{t-i} + u_t. \quad (2)$$

Accordingly, the absence of a cointegrating relationship between  $(I/Y)_t$  and  $(OFDI/Y)_t$  is tested by calculating the  $F$ -statistic for the null of no cointegration  $H_0 : b_2 = b_3 = b_4 = 0$  against

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<sup>1</sup> According to UNCTAD data, the US ranked at the top in terms of OFDI stocks in 2004, while Germany was at

the alternative  $H_1 : b_2 \neq b_3 \neq b_4 \neq 0$ . Because the  $F$ -statistics have a non-standard distribution and depend on whether the variables are  $I(0)$  or  $I(1)$ , Perasan et al. (2001) provide two sets of critical values: one assumes that all variables are  $I(0)$ , the other assumes that all variables are  $I(1)$ . If the calculated  $F$ -statistic falls below the lower bound critical value, then the null of no cointegration cannot be rejected. If, in contrast, the  $F$ -statistic lies above the upper bound critical value, then the null hypothesis is rejected. If the  $F$ -statistic falls within the critical value bounds, the result is inconclusive.

To determine whether a deterministic trend is required, we estimate equation (2) with and without  $t$ . It turns out that only for the US a trend is needed in equation (2). For Germany, the trend is not supported by the data and hence is excluded from the equation. Moreover, for the US, two impulse dummies,  $D75$  and  $D84$ , are necessary to achieve a normal distribution of the residuals.  $D75$  captures the effects of the recession in 1974-75, and  $D84$  accounts for fast economic recovery in 1984 after the 1982-83 recession. For Germany, an impulse dummy variable,  $D79$ , is included in order to control for the business cycle peak in 1979. Because all standard lag selection criteria unanimously suggest  $k = 1$  for the US and  $k = 2$  for Germany, respectively, we estimate the ARDL model with one lag for the US and two lags for Germany.

The calculated  $F$ -statistics along with some residual diagnostics are reported in Table 1.  $LM(k)$ ,  $k = 1, 3$  are Lagrange Multiplier (LM) tests for autocorrelation based on  $k$  lags,  $ARCH(k)$  is an LM test for autoregressive conditional heteroscedasticity, and JB is the Jarque-Bera test for normality. Given that all  $p$ -values exceed the conventional significance levels, we conclude that the residuals do not show any signs of non-normality, autocorrelation or conditional heteroscedasticity. Furthermore, the CUSUM of squares tests in Figure 1 indicate that the estimated equations are stable. Thus, statistically valid inferences can be drawn regarding the cointegration of  $(I/Y)_t$  and  $(OFDI/Y)_t$ : because the calculated  $F$ -statistics in Table 1 are higher



than the upper bound critical values, we reject the null of no cointegration at the 1% significance level.

### 3.2. Estimating the long-run relationships

In the next step, we use the Phillips and Loretan (1991) procedure to estimate the long-run coefficients. This procedure generates asymptotically efficient estimates for variables that cointegrate, even with endogenous regressors, by including leads and lags of the first differences of the explanatory variables. Moreover, it deals with the autocorrelation of the residuals by including lagged values of the stationary deviation from the cointegrating relationship.

Let  $y_t$  denote the vector  $[1, t, (OFDI/Y)_t]'$  and let  $\lambda$  denote the corresponding coefficient vector  $[a_1, a_2, a_3]'$ . The Phillips-Loretan Equation is given by

$$\left(\frac{I}{Y}\right)_t = \lambda' y_t + b \left[ \left(\frac{I}{Y}\right)_{t-1} - \lambda' y_{t-1} \right] + \sum_{i=-k}^{i=k} \Phi_i \Delta \left( \frac{OFDI}{Y} \right)_{t-i} + \sum_i^m \mu_i D_{i,t} + \varepsilon_t, \quad (3)$$

where  $D_{i,t}$  are impulse dummies. Again, for the US the impulse dummies  $D75$  and  $D84$  are introduced. For Germany the dummy variables  $D76$  and  $D81$  are needed in addition to  $D79$ . Possible reasons for the importance of  $D76$  and  $D81$  are the swift economic recovery in 1976 after the recessions of 1973-75 and 1981. The Phillips-Loretan Equation is estimated with up to two leads and lags ( $k=2$ ). After applying the general-to-specific approach, we obtain the following results (Table 2).

For the US, the estimated coefficient on  $(OFDI/Y)_t$  is 4.0588, implying that a one-dollar increase in outward investment leads to a four-dollar increase in domestic investment. This is very close to the results of Desai et al. (2005), who found that an additional dollar of outward investment by US multinational firms is associated with 3.5 dollars of domestic investment (by the same multinational firms). In contrast to this, in the case of Germany the coefficient on

$(OFDI/Y)_t$  has a negative sign. This can be interpreted in the sense that German OFDI is crowding out domestic investment activities in the long run. More concretely, the value of  $-1.4091$  implies that total domestic investment decreases by 1.4 dollars due to a one-dollar increase in outward direct investment.

### 3.3. Testing for causality

However, it remains an open question, whether domestic investment is actually “caused” by OFDI. Therefore, in the final step, we test for causality in the sense of Granger (1988). For this purpose, the residuals from the long-run relations in Table 2,

$$ec_t = \left(\frac{I}{Y}\right)_t - \left[7.5449 - 0.2179t + 4.0588\left(\frac{OFDI}{Y}\right)_t\right] \text{ and} \quad (4)$$

$$ec_t = \left(\frac{I}{Y}\right)_t - \left[5.5632 - 1.0491\left(\frac{OFDI}{Y}\right)_t\right], \quad (5)$$

respectively, are entered as error correction terms into an error correction model, in which we allow for up to two lags. Table 3 reports the results using the general-to-specific approach.

As expected, the lagged error correction terms,  $ec_{t-1}$ , are negative and highly significant, which implies co-integration as well as long-run Granger causality from outward to domestic investment in both countries (e.g., Granger, 1988). Obviously there are no statistically significant short-run effects for the US. For Germany, in contrast, the short-run dynamics are statistically significant and positive. Accordingly, in Germany, outward FDI has positive short-run but negative long-run effects on domestic investment.

### **3. Conclusions**

The empirical evidence presented in this paper suggests that the impact of OFDI on domestic investment differs across countries. In the case of the US, OFDI has positive long-run effects on domestic investment. Following the explanation by Desai et al. (2005), this estimated complementary relationship implies that American multinational firms combine home production with foreign production to reduce costs and raise the return to domestic production, thus stimulating domestic output and domestic investment. However, for Germany, we find that OFDI substitutes for German domestic investment. These differences might be due to differences in the overall investment opportunities due to the legal framework. Therefore, a closer look at a broader set of indicators and countries using heterogeneous panel techniques might be a natural extension of this paper.

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Figure 1

Stability Analysis for model (2): CUSUM of squares and 5% significance bounds

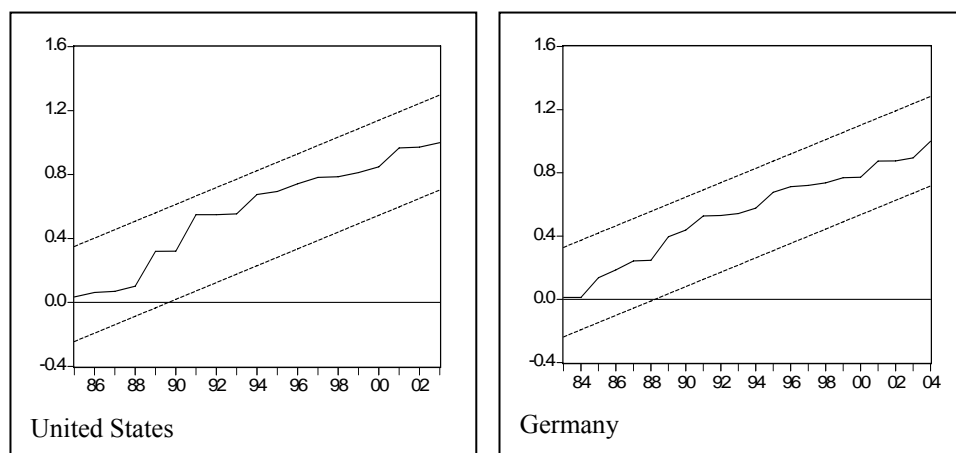


Table 1:

## ARDL Cointegration test

Country	Lags	Regressors	$H_0$	$F$ - statistics	Critical value bounds (1%)		Diagnostic tests						
					$I(0)$	$I(1)$	$\bar{R}^2$	SE	$LM(1)$	$LM(3)$	$Arch(1)$	$Arch(3)$	JB
US	1	$(OFDI/Y)_t, t$	$b_2=b_3=$ $b_4=0$	7.221***	6.10	6.73	0.86	0.78	0.23 (0.63)	0.20 (0.89)	1.02 (0.32)	0.60 (0.62)	0.26 (0.88)
Germany	2	$(OFDI/Y)_t$	$b_2=b_4=0$	8.865***	6.84	7.84	0.63	0.91	0.02 (0.90)	0.13 (0.94)	0.13 (0.72)	1.04 (0.39)	1.39 0.49

For Germany the relevant critical value bounds are from Pesaran et al. (2001), Table CI(iii) Case III: Unrestricted intercept and no trend; for the United States from Table CI(iv) Case IV: Unrestricted intercept and restricted trend.

\*\*\* denote the 1% level of significance.

Table 2:

Long-run relationships: Phillips and Loretan (1991) nonlinear least squares

Independent variable	United States	Germany
Constant	7.5449*** (3.89)	5.5632*** (3.06)
Trend	-0.2179*** (-3.50)	
$\left(\frac{OFDI}{Y}\right)_t$	4.0588*** (2.92)	-1.4091** (-2.19)
$\left[\left(\frac{I}{Y}\right)_{t-1} - a_2 t - a_3 \left(\frac{OFDI}{Y}\right)_{t-1}\right]$	0.6159*** (6.36)	
$\left[\left(\frac{I}{Y}\right)_{t-1} - a_3 \left(\frac{OFDI}{Y}\right)_{t-1}\right]$		1.1555*** (10.51)
$\left[\left(\frac{I}{Y}\right)_{t-2} - a_3 \left(\frac{OFDI}{Y}\right)_{t-2}\right]$		-0.3940*** (-3.16)
$\Delta\left(\frac{OFDI}{Y}\right)_t$	-2.6292** (-2.07)	1.4086** (2.37)
D75	-3.2960*** (-4.09)	
D76		1.8027** (2.60)
D79		2.2796** (2.43)
D81		-2.118** (-2.24)
D84	2.9480*** (3.73)	
Diagnostic tests		
$\bar{R}^2$	0.74	0.83
LM(1)	0.18 (0.68)	1.24 (0.27)
Arch(1)	1.97 (0.17)	0.03 (0.87)
JB	0.17 (0.91)	1.66 (0.44)

\*\*\* (\*\*) denote the 1% (5%) level of significance. t-statistics are given in parentheses alongside the estimated coefficients. Numbers in parentheses alongside the values of the diagnostic test statistics are the corresponding  $p$ -values.

Table 3

Error correction model: Long-run and short-run causality

Dependent variable: $\Delta\left(\frac{I}{Y}\right)_t$		
Independent variable	United States	Germany
Constant	6.49*** (4.26)	8.54*** (4.35)
$\Delta\left(\frac{I}{Y}\right)_{t-1}$	—	0.29* (2.00)
$\Delta\left(\frac{I}{Y}\right)_{t-2}$	—	—
$\Delta\left(\frac{OFDI}{Y}\right)_{t-1}$	—	0.68** (2.65)
$\Delta\left(\frac{OFDI}{Y}\right)_{t-2}$	—	0.68** (2.35)
$ec_{t-1}$	-0.33*** (-4.28)	-0.37*** (-4.53)
$D75$	-2.85*** (-3.35)	—
$D76$	—	1.46** (2.08)
$D79$	—	2.49** (2.75)
$D84$	2.99*** (3.51)	—
Diagnostic tests		
$\bar{R}^2$	0.52	0.52
$LM(1)$	0.04 (0.85)	0.01 (0.91)
$Arch(1)$	0.54 (0.47)	0.36 (0.55)
JB	1.60 (0.45)	0.51 (0.78)

\*\*\* (\*\*) [\*] denote the 1% (5%) [10%] level of significance. t-statistics are given in parentheses alongside the estimated coefficients. Numbers in parentheses alongside the values of the diagnostic test statistics are the corresponding  $p$ -values.